



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/680,895	10/08/2003	Helen Zhu	P1052-LAM (RAO#1)	5978
48008	7590	09/06/2005	EXAMINER	
VIRTUAL LEGAL, P.C. MICHAEL A. KERR 3476 EXECUTIVE POINTE WAY, UNIT 16 CARSON CITY, NV 89706			NGUYEN, THANH T	
			ART UNIT	PAPER NUMBER
			2813	

DATE MAILED: 09/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/680,895	ZHU ET AL.	
	Examiner	Art Unit	
	Thanh T. Nguyen	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 June 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date: _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date: _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 6/20/05 have been fully considered but they are not persuasive.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-26 are stand rejected under 35 U.S.C. 103(a) as being unpatentable over Chen (U.S. Patent No. 5,970,376) in view of Pangrle et al. (U.S. Patent No. 6,566,283) and Wu et al. (U.S. Patent No. 6,720,256) and Hsue et al. (U.S. Patent No. 6,696,222).

Referring to figures 8-11, Chen teaches a method of forming a damascene structure comprising:

forming an silsesquioxane layer (66, called OSG, see figure 8, col. 17-33),

forming a cap layer or hardmask (68) on the OSG layer,

forming a photoresist layer (70, see col. 14, lines 46-55), etching the cap layer and the OSG layer to form a via (68a, see figure 9).

Art Unit: 2813

Removing the photoresist layer by using nitrous oxide (see figures 6-7, 10-11, col. 10, lines 51-67, col. 11, lines 1-13, col. 15-16, lines 56+), wherein the oxygen containing gas consisting of nitrous oxide (see col. 11, lines 1-3). Therefore, when removing the photoresist layer (70 in figure 10) using the oxygen containing gas, the nitrous oxide can be used for the removal. Noted that substitution of one known equivalent technique for another may be obvious even if the prior art does not expressly suggest the substitution. *Ex parte Novak* 16 USPQ 2d 2041 (BPAI 1989); *In re Mostovych* 144 USPQ 38 (CCPA 1964); *In re Leshin* 125 USPQ 416 (CCPA 1960); *Graver Tank & Manufacturing Co. V. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Generating a high selectivity between the photoresist and the OSG. It is inherent that since removing the photoresist layer without removing the organic material (OSG) it would generating the high selectivity.

Regarding to claim 2, 7, 18, the photoresist is an organic photoresist. Noted that it is known in the art that photoresist is made of organic material.

Regarding to claims 4, 8, the stripping of the photoresist is performed in the same reactor used for etching the OSG material (see col. 17, lines 3-9).

Regarding to claim 6, since remove the photoresist without remove the hardmask and the OSG film, therefore it would generating a high selectivity.

Regarding to claim 10, the intermediate layer is a cap layer (68, see figure 8).

Regarding to claim 11, cap layer is selected from a group consisting of silicon dioxide (see col. 14, lines 10-15, 37-45).

Regarding to claim 12, the second intermediate layer is a hard mask layer (called capping layer, 68, col. 14, lines 36-45).

However, the reference does not teach silsesquioxane-SOG is an OSG layer, forming a dual damascene, etching the trench into the second hardmask layer and apply another the photoresist layer to form a via etch by etching into the OSG layer, providing a via etched into the IC structure, generating an organic plug that occupies the via; and stripping organic plug, the hardmask layer selected from the group consisting of silicon nitride.

Pangrle et al. teaches a low k dielectric layer (12) silsesquioxane SOG such as OSG film (see col. 5, lines 15-26).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made to form a low k dielectric layer such as OSG film in process of Chen as taught by Pangrle et al. because silsesquioxane SOG is known in the art to include the OSG film with a low dielectric constant.

Wu et al. teaches forming a dual damascene (see figure 6d), forming the hardmask layer selected from the group consisting of silicon nitride (see col. 9, lines 62-67), providing a via etched into the IC structure (see figure 6a), Generating an organic plug (80, called resin) that occupies the via; and Stripping organic plug (see figure 6d-6e).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would form a dual damascene, providing a via etched into the IC structure, generating an organic plug that occupies the via, and stripping organic plug, the hardmask layer selected from the group consisting of silicon nitride in process of Chen as

Art Unit: 2813

taught by Wu et al. because the process would provide a wider process latitude and higher yield during the formation of dual damascene structures are provided. The method is resistant to poisoning from adjacent layers and does not form scum or residue in via holes during trench patterning, and is compatible with high throughput, low cost manufacturing process.

Hsue et al. teaches a method of forming a dual damascene process using metal hardmask layer comprising the step of: etching the trench into the second hardmask layer (see figure 2b-2c) and apply another the photoresist layer (44) to form a via etch (45) by etching into the OSG layer (36, see figure 2d-2f).

Therefore, it would have been obvious to a person of ordinary skill in the requisite art at the time of the invention was made would etching the trench into the second hardmask layer and apply another the photoresist layer to form a via etch by etching into the OSG layer in process of Chen as taught by Hsue et al. because the process would reduce RC delay and cross talk, lower production cost and simplify the dual damascene process

Response to Arguments

Applicant's arguments filed 6/20/05 have been fully considered but they are not persuasive.

Applicant contends that Chen does not teach using the nitrous oxide (N₂O) for stripping of the photoresist from the IC structure and an OSG. In response to applicant that Chen clearly teaches using the nitrous oxide (N₂O) for stripping of the photoresist from the IC structure and

Art Unit: 2813

an OSG (see figures 6-7, 10-11, col. 10, lines 51-67, col. 11, lines 1-13, col. 15-16, lines 56+), wherein the oxygen containing gas consisting of nitrous oxide (see col. 11, lines 1-3). Therefore, when removing the photoresist layer (70 in figure 10) using the oxygen containing gas, the nitrous oxide can be used for the removal.

Applicant contends that Pangrle low dielectric has never developed successfully within a process of Chen. In response to applicant that examiner only relies on Pangrle to show a low k dielectric layer silsesquioxane SOG is also known as OSG film. The term is known in the art.

Applicant contends that Hsue teaches a method of forming a dual damascene process wherein the claim invention is not directed to a dual damascene process. In response to applicant that the process of the instant invention does not exclude the method of forming a dual damascene process. Therefore, one of ordinary skill can use any known process to meet the claimed invention.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,


Art Unit: 2813

however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh Nguyen whose telephone number is (571) 272-1695, or by Email via address Thanh.Nguyen@uspto.gov. The examiner can normally be reached on Monday-Thursday from 6:00AM to 3:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on (571) 272-1702. The fax phone number for this Group is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956 (See **MPEP 203.08**).

A handwritten signature in black ink, appearing to read 'Thanh', with a long horizontal stroke extending to the left and a smaller flourish to the right.

Thanh Nguyen
Patent Examiner
Patent Examining Group 2800

TTN